# 2008 GROUNDWATER MONITORING WORK PLAN

Boeing Former C-6 Facility
19503 South Normandie Avenue
Los Angeles, California

February 4, 2008

**PREPARED FOR**

The Boeing Company
4501 Conant Street
Building 851, M/C D851-0097
Long Beach, California 90808

**PREPARED BY**

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Project No. 1155.003

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February 4, 2008 Project No. 1155.003

Ms. Ana Townsend
CALIFORNIA REGIONAL WATER QUALITY
CONTROL BOARD, LOS ANGELES REGION
320 West 4th Street, Suite 200
Los Angeles, California 90013

**2008 Groundwater Monitoring Work Plan**
**Boeing Former C-6 Facility**
19503 South Normandie Avenue
Los Angeles, California

Dear Ms. Townsend:

Enclosed is the 2008 Groundwater Monitoring Work Plan for the subject site. If you have any questions or require additional information, please do not hesitate to call.

Respectfully submitted,

AVOCET ENVIRONMENTAL, INC.

Michael A. Rendina, P.G.
Principal

MAR:sh
Enclosure
cc: Ms. Jennifer Wiley – The Boeing Company (PDF only)
Mr. Joe Wiedmann – Haley & Aldrich (PDF only)
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|---|---|
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| bgs | below ground surface |
| B-Sand | Middle Bellflower B-Sand |
| Cal/OSHA | California Division of Occupational Safety and Health |
| CDM | Camp Dresser & McKee, Inc. |
| C-Sand | Middle Bellflower C-Sand |
| DO | dissolved oxygen |
| EPA | U.S. Environmental Protection Agency |
| gpm | gallon per minute |
| HASP | Health and Safety Plan |
| ILM | Industrial Light Metals |
| IRZ | In-situ Reactive Zone |
| LARWQCB | Los Angeles Regional Water Quality Control Board |
| LBF | Lower Bellflower aquitard |
| L/min | liter per minute |
| MBFM | Middle Bellflower Mud |
| mg/L | milligram per liter |
| mL | milliliter |
| mL/min | milliliter per minute |
| MRP | Monitoring and Reporting Program |
| mS/cm | milliSiemen per centimeter |
| mV | millivolt |
| OSHA | Occupational Safety and Health Administration |
| PID | photo-ionization detector |
| NTU | nephelometric turbidity unit |
| QA | quality assurance |
| QC | quality control |
| UBF | Upper Bellflower aquitard |
| µg/L | microgram per liter |
| VOC | volatile organic compound |
| WDR | Waste Discharge Requirements |

# 1.0 INTRODUCTION

Avocet Environmental, Inc. (Avocet), on behalf of Boeing Corporate Real Estate (BCRE)[1], has prepared this work plan for continuing groundwater monitoring at The Boeing Company (Boeing's) Former C-6 Facility (the site) in Los Angeles, California (Figure 1). More than 50 groundwater monitoring events have been performed at the site since 1987 and two monitoring events are planned for 2008, as listed below:

- A site-wide annual event in March.
- A plume-boundary-specific, semiannual monitoring event in September.
- If additional monitoring wells are installed during 2008, they will be added to the quarterly sampling program and sampled for four consecutive quarters.

This work plan identifies the groundwater monitoring wells that will be sampled and the constituents and parameters that will be measured during each event. Groundwater monitoring activities related to ongoing or upcoming bioremediation pilot tests are discussed in the *Addendum to Building 1/36 (Parcel C) Source-Area Groundwater In-Situ Reactive Zone Pilot Study Workplan* (Camp Dresser McKee, Inc. [CDM], February 1, 2007) and the *Addendum No. 2 to the Building 2 In-Situ Reactive Zone Pilot Test Workplan, C-Sand Bioremediation Amendment Injections* (CDM, January 25, 2008). This sampling program is separate from, but may overlap, groundwater monitoring program(s) anticipated for 2008 under Monitoring and Reporting Program (MRP) No. CI-9310 and Individual Waste Discharge Requirements (WDR) Order No. R4-2007-0040 related to groundwater remediation. Results from the WDR monitoring program(s) will be submitted in separate reports. This work plan presents the site background, the proposed groundwater monitoring program, and the reporting.

## 1.1 BACKGROUND

The Former C-6 Facility comprises approximately 170 acres and is bounded by 190th Street to the north; Normandie Avenue to the east; former industrial parcels, including the Montrose Chemical Superfund site (Montrose), to the south; and the former Industrial Light Metals (ILM) site to the west (Figure 1). Between approximately 1952 and 1992, the site was used for aerospace manufacturing operations. Operations at the site ceased in the mid-1990s, the buildings were demolished, and most of the parcels were sold and redeveloped for commercial/ light industrial uses. Environmental studies conducted at the site since the 1980s indicate that groundwater beneath the site contains volatile organic compounds (VOCs). These VOCs have been the focus of past and continuing remediation efforts at the site.

[1] Formerly Boeing Realty Corporation.

### 1.1.1 Site Geology

The site is located on the Torrance Plain physiographic area of the West Coast Basin and is underlain by the Lakewood Formation. The Lakewood Formation is subdivided into two principal hydrostratigraphic units: the Bellflower unit and Gage aquifer. The Bellflower unit is further subdivided into the following:

- Upper Bellflower aquitard (UBF)
- Middle Bellflower B-Sand (B-Sand)
- Middle Bellflower Mud (MBFM)
- Middle Bellflower C-Sand (C-Sand)
- Lower Bellflower aquitard (LBF)

The UBF comprises the upper 20 to 60 feet of the Bellflower unit and consists of fine-grained soils (predominantly fine sands, silts, and clays), which thicken to the east. A sandy zone (Middle Bellflower Sand) that dips downward to the east underlies the fine-grained soils. The Middle Bellflower Sand is generally 60 to 100 feet thick and is a massive, light yellowish-brown, fine to medium sand with discontinuous layers of fine-grained sediment (silt and clay) that also dip downward to the east. A fine-grained layer, referred to as the Middle Bellflower Mud (MBFM), locally interrupts this sand. The top sand subunits are referred to as the B-Sand and the bottom sand subunits as the C-Sand. The MBFM is discontinuous across the site, but where present, ranges in thickness from about 1 foot to 13 feet and is comprised of laminated clay, silt, and very fine sand. The MBFM thins toward the north and appears to be absent in the northern portion of the site (most of the former Building 1/36 portion of the site).

The Middle Bellflower Sand is underlain by the Lower Bellflower aquitard (LBF), another fine-grained zone, at depths ranging from about 120 to 140 feet below ground surface (bgs). The fine-grained LBF ranges in thickness from 10 to 20 feet and appears to be continuous across the site. The LBF separates the Middle Bellflower Sand from the underlying Gage aquifer.

### 1.1.2 Site Hydrogeology

Groundwater at the site is encountered at depths of approximately 55 to 70 feet bgs in the relatively permeable sediments of the Bellflower unit. Most of the groundwater monitoring wells at the site have been installed in the B- and C-Sands within the Bellflower unit.

The B-Sand is found at approximate depths of 55 to 70 feet bgs at the site, and is generally 25 to 40 feet thick. The B-Sand consists of predominately interbedded fine sands and silts. The most recent (September 2007) groundwater monitoring data for the site (CDM, November 29, 2007) indicates the groundwater flow within the B-Sand to be predominantly toward the southwest with an average gradient of 0.0009 ft/ft.

The C-Sand is found at approximate depths of 90 to 110 feet bgs at the site and extends to depths of 120 to 140 feet bgs. The C-Sand consists largely of interbedded very fine sands with silt and

clay. Groundwater flow within the C-Sand is predominantly to the south, with an average gradient of 0.0009 ft/ft (CDM, November 29, 2007).

The Gage aquifer in the site vicinity occurs at an approximate depth of 150 feet bgs and ranges in thickness from 40 to 50 feet (Haley and Aldrich, December 8, 2005). The Gage aquifer is comprised largely of sand. Groundwater flow within the Gage aquifer is generally to the southeast with an average gradient of 0.0009 ft/ft (CDM, November 29, 2007).

## 1.2 GROUNDWATER MONITORING WELL SUMMARY

Groundwater wells installed at the site are classified as follows:

- Groundwater monitoring wells installed by BCRE and its predecessors (prefixes include DAC, EWB, MWB, TMW, WCC, CMW, EWC, IWC, MWC, and MWG).
- Groundwater monitoring wells installed by ILM for investigations at its facility (prefix BL).
- Groundwater monitoring wells installed by Montrose for investigations at its facility (prefix XMW).
- Groundwater monitoring wells installed by BCRE in support of bioremediation pilot testing (prefixes IRZ).

Groundwater investigations began in early 1987 with the installation of the first groundwater monitoring wells. A total of 88 groundwater monitoring wells have since been installed at the site. Twenty of these groundwater monitoring wells have been destroyed as a result of redevelopment activities.

As of December 2007, a total of 68 groundwater monitoring wells exist at the site. This includes the 13 bioremediation groundwater monitoring wells (10 B-Sand and 3 C-Sand wells) installed in the southern portion of the site to monitor the effectiveness of a now-completed In-situ Reactive Zone (IRZ) bioremediation pilot test. Completion details for all 68 groundwater monitoring wells are included in Table 1 and the well locations are shown on Figure 2.

More than 50 groundwater monitoring events have taken place at the site since monitoring began in 1987. All of the groundwater monitoring wells were typically sampled during each groundwater monitoring event, performed quarterly, until 1997. In 2000, the groundwater monitoring program was modified to two events per year: one full annual monitoring event and one plume-boundary-specific semiannual monitoring event (Kennedy Jenks Consultants, December 15, 2000).

# 2.0 PROPOSED GROUNDWATER MONITORING PROGRAM

The proposed 2008 groundwater monitoring program consists of two sampling events:

A site-wide annual event in March 2008.
- A plume-boundary-specific semiannual monitoring event in September 2008.

The above events are described in Sections 2.1 and 2.2. General monitoring considerations are described in Section 2.3. The monitoring program is presented in Table 2 and Figures 3 and 4. As stated previously, this monitoring is separate from, but may overlap, WDR-specific groundwater monitoring being performed at the site. At times during the monitoring events, sampling at certain wells will concurrently satisfy both groundwater monitoring and WDR-specific monitoring requirements. In addition, if any monitoring wells are installed during 2008, they will be added to the quarterly sampling program and sampled for four consecutive quarters.

Some additional sampling and analyses, as appropriate, are also proposed for certain wells to collect additional data for evaluating remedial activities at the site.

## 2.1 ANNUAL GROUNDWATER MONITORING

The site-wide annual monitoring event will be performed in March 2008. Groundwater monitoring will be performed at 54 groundwater monitoring wells and 9 bioremediation monitoring wells, as indicated in Table 2 and shown on Figure 3. This task will consist of the following activities:

- Measure static groundwater in 63 groundwater monitoring wells.
- Measure field parameters, including pH, temperature, specific conductance, dissolved oxygen (DO), and redox potential, using a calibrated sonde and flow-through cell at 63 wells[2]. A turbidity meter (Hach 2100P or equal) will be used to periodically measure turbidity of the water during purging.
- Analyze 10 percent of the samples in the field using a CHEMetrics, Inc. test kit (K-7512 or K-7540) as a quality assurance (QA) check on DO measurements.
- Collect groundwater samples from the 63 monitoring wells and analyze for VOCs by EPA Method 8260B.

[2] Five wells have been eliminated from the annual program because they duplicate the results of nearby wells. Well TMW_04 was eliminated because it is duplicated by MWB005. Wells IRZMW002A/B and IRZMW003A/B were eliminated because they duplicate the results of IRZMW001A/B. Concentration-versus-time graphs illustrating the close agreement of water quality analyses from these wells are presented in Appendix B.

- Collect quality control (QC) samples consisting of duplicates (1 per 20 wells) and equipment/rinsate and trip blanks (each at a rate of 1 per day of sampling).

- Perform data validation on approximately 10 percent of the laboratory data for the primary samples as described in Section 2.3.7.4.

The monitoring methodology is presented in Section 2.3. If selected wells cannot be accessed for any reason, they will be scheduled for gauging and sampling during the next sampling event. Groundwater monitoring wells installed at the site by Montrose and ILM will be accessed through coordination with their respective environmental contractors.

## 2.2 SEMIANNUAL GROUNDWATER MONITORING

The semiannual monitoring event will be performed in September 2008. Groundwater monitoring will be performed at a reduced number (28)[3] of groundwater monitoring wells, as indicated in Table 2 and shown in Figure 4, and will focus primarily on the boundaries of the groundwater plumes. This task will consist of the following activities:

- Measure static groundwater in 40 groundwater monitoring wells.

- Measure field parameters, including pH, temperature, specific conductance, DO, and redox potential, using a calibrated sonde and flow-through cell, at 28 wells. A turbidity meter will be used to periodically measure turbidity.

- Analyze 10 percent of the samples in the field using a CHEMetrics, Inc test kit (K-7512 or K-7540) as a QA check on DO measurements.

- Collect groundwater samples from 28 monitoring wells and analyze for VOCs using EPA Method 8260B.

- Collect QC samples consisting of duplicates (1 per 20 wells) and equipment/ rinsate and trip blanks (each at a rate of 1 per day of sampling).

- Perform data validation on approximately 10 percent of the laboratory data for the primary samples, as described in Section 2.3.7.4.

The monitoring methodology is presented in Section 2.3. If selected wells cannot be accessed for any reason, they will be scheduled for gauging and sampling during the next sampling event.

[3] The number of wells proposed for sampling (28) reflects a six-well reduction from the 34 proposed in the 2007 Groundwater Monitoring Work Plan (CDM, February 5, 2007). The six wells (EWB001, EWC001, EWC002, IWC001, IWC002, and MWC024), installed during October and November 2006, were sampled quarterly during 2007, and since they are not located in plume boundary areas, are delegated to the annual sampling program.

## 2.3 GROUNDWATER MONITORING METHODOLOGY

### 2.3.1 Health and Safety

The work will be performed by Avocet under a site-specific Health and Safety Plan (HASP), which has been developed in accordance with the federal Occupational Safety and Health Administration (OSHA) and California Division of Occupational Safety and Health (Cal/OSHA) regulations (Title 29 CFR, Section 1910.120 and 8 CCR 5192).

### 2.3.2 Groundwater Monitoring and Sampling

BCRE will notify the Los Angeles Regional Water Quality Control Board (LARWQCB) a minimum of one week prior to the start of groundwater monitoring events. The activities described in the subsequent paragraphs will be performed.

### 2.3.3 Water Level Gauging

Prior to sampling each monitoring well, depth to groundwater will be measured to the nearest one-hundredth of a foot using an electronic water level sounder. Data from the well gauging will be recorded in the Groundwater Monitoring Well Gauging Sheet (Appendix A), as well as in an electronic format for upload to the project database. Monitoring well vapor concentrations will be measured with a photoionization detector (PID) following the removal of the well cap, and the results will be recorded on the Gauging Sheet. The Gauging Sheet will also include information on the surface condition of each well and any repairs/modifications required or that may have been conducted. During each monitoring event, all water level measurements will be collected within a single 24-hour period using the same water sounding tape. Water levels in wells with submerged screens that are noted to be under pressure upon removal of the well cap will be allowed time to stabilize prior to water level gauging.

### 2.3.4 Well Purging

During each event, groundwater monitoring wells will be sampled in order of increasing concentrations. The sampling order will be determined based on the most recent groundwater analytical data available at the time of sampling and will consider any WDR wells included in the event.

Prior to collecting ground water samples for chemical analysis, wells scheduled to be sampled will be purged to assure representative samples are collected from the formation. Historically, groundwater sampling conducted for site characterization has been performed using conventional (i.e., three to five wetted casing volumes) purging methods, whereas sampling conducted to monitor in-situ bioremediation has been performed using low-flow (i.e., minimal drawdown) purging methods. On January 15, 2008, a letter report presenting a comparison of historical VOC analytical results for several wells sampled using both low-flow and conventional purging methods was submitted to the LARWQCB. The comparison revealed a good correlation between sampling methods, and the report stated Boeing's intention to transition to the low-flow sampling method beginning with the March 2008 groundwater monitoring event. As a

contingency measure, this work plan includes procedures for both low-flow and conventional sampling in the event LARWQCB does not approve this transition prior to the March 2008 event.

#### *2.3.4.1 Low-flow Purging and Sampling*

Low-flow purging differs from traditional methods of purging in that its use is based on the observation that water moving through the formation also moves through the well screen. Thus, the water in the screen is representative of the formation water surrounding the screen. Low-flow purging involves removing water directly from the screened interval without disturbing any stagnant water above the screen. This is done by pumping the well at a low enough flow rate to maintain minimal drawdown of the water column within the well, as determined through water-level measurement during pumping. The objective is to pump in a manner that minimizes stress to the ground water system to the extent practical. Pumping at low rates, in effect, hydraulically isolates the column of stagnant water in the well and negates the need for its removal prior to sample collection. Typically, flow rates on the order of 0.1 to 0.5 liter per minute (L/min) are used; however, this is dependent on site-specific and well-specific factors, as drawdown should be minimized to the extent possible. Pumping water levels in the well and water quality indicator parameters (such as pH, temperature, specific conductance, DO, and redox potential) should be monitored during pumping, with stabilization indicating that purging is completed (i.e., access to formation-quality water is confirmed) and sampling can begin.

Low-flow purging will be conducted using either portable or dedicated, pneumatic (bladder) or electric submersible pumps, as long as the pump has adjustable flow rate controls and is capable of being run at a low enough flow rate to avoid causing continuous drawdown in the well. The pump will be installed with the intake positioned near the mid-point of the well screen (or in water table wells near the mid-point of the saturated well screen interval). After the pump intake is properly set in the well, the pump will be started at a low pumping rate, generally 100 milliliters per minute (mL/min) or, if 100 mL/min is not possible, the lowest flow rate possible. From the time the pump is started, the water level in the well will be measured periodically to determine the amount of drawdown caused by the pumping. The pumping rate may then be adjusted, either up or down, until drawdown stabilizes. Although several researchers have proposed limits on the amount of drawdown that should be allowed before stabilization occurs (e.g., 0.33 feet, Puls and Barcelona, 1996), none have provided any scientific rationale for the limits. ASTM International suggests that drawdown be limited to 25 percent of the distance between the top of the well screen and the pump intake; this equates to 2.5 feet in a well with 10 feet of saturated screen interval. Since the objective of low-flow purging is to minimize stress on the formation to the extent practical, and drawdown is a measurable indicator of stress, Avocet will endeavor to limit drawdown prior to stabilization to 0.5 foot or less.

Water quality indicator parameters, including pH, temperature, specific conductance, DO, and redox potential, will be measured in a closed flow-through cell to determine when purging is complete and sampling can commence. Though not a chemical parameter, turbidity is an indicator of stress on the formation and turbidity measurements will be recorded, at a minimum,

once when pumping is initiated and again just prior to sample collection, after indicator parameters have stabilized. Indicator parameters will be considered stable when three consecutive readings made several minutes apart fall within the following ranges:

- ±0.2 pH units
- ±3 percent of the specific conductance measurement or 0.02 milliSiemen per centimeter (mS/cm), whichever is greater
- ±10 percent of the DO reading or ±0.2 mg/L, whichever is greater
- ±20 millivolts (mV) for redox potential measurements
- ±10 percent of the turbidity measurement or ±1.0 nephelometric unit (NTU), whichever is greater

The first reading will be recorded after stagnant water has been purged from the pump, discharge tubing, and one volume of the flow cell – about 1 to 2 liters depending on the volume of the flow cell. The frequency of subsequent measurements will be based on the time required to completely evacuate one volume of the flow cell, to ensure that independent measurements are made. Avocet intends to utilize the QED MP20 flow cell, which has a volume of 175 mL; therefore, depending on the flow rate; measurements will be recorded every two minutes or less. After drawdown and chemical indicator parameters stabilize, sampling may begin. Sampling will be performed by disconnecting the inflow line from the flow cell and discharging the water directly into laboratory-supplied sample containers. Groundwater well purge information, including the equipment used, pump placement, initial static and final water levels, initial and final pumping rates, and water quality indicator and turbidity measurements, will be recorded on the Groundwater Sampling Data Sheet, an example of which is included in Appendix A.

*2.3.4.2 Conventional Purging and Sampling*

Traditional or conventional volume purging involves removing three to five wetted casing volumes of water with a pump. Wetted casing volume will be calculated using the static water level, total well depth, and casing diameter, as indicated below:

$$V = \pi r^2 h \quad (7.48)$$

where: V = one wetted casing volume (gallons)
r = inner radius of well casing (in feet)
h = length of water column (in feet)

Due to the relatively large volume of water that must be removed from each well, this purging method will utilize an electric submersible pump. The intake of the submersible pump will be positioned near the mid-point of the well screen (or in water table wells, near the mid-point of the saturated well screen interval). After the pump intake is properly set in the well, the pump will be started at a rate of less than 2 gallons per minute (gpm) for 4-inch-diameter wells and 1 gpm for 2-inch-diameter wells. The water level will be monitored during purging and the

purge rate will be adjusted so that the draw-down in the well is minimized to prevent groundwater from cascading down the interior sidewalls of the well casing.

During purging, water quality indicator parameters, including pH, temperature, specific conductance, DO, and redox potential, will be measured in a closed flow-through cell to determine when purging is complete and sampling can commence. Turbidity measurements will be recorded at the same time that chemical parameter measurements are made. The indicator parameters will be measured using a Horiba U-22XD (or equivalent) multi-parameter water quality instrument equipped with a flow-through cell (approximately 1-liter capacity). The Horiba U-22XD will be calibrated in accordance with the manufacturer's instructions. As an additional calibration check, at least 10 percent of the dissolved oxygen measurements will be field checked using a CHEMetrics test kit. Indicator parameters will be measured throughout the purging process, with readings recorded at the start of purging, after each wetted casing volume, and at the end of purging. Purging will be deemed complete when a minimum of three wetted casing volumes have been removed and three consecutive indicator parameter measurements achieve the stabilization criteria presented in the previous section. If parameters do not stabilize after five wetted casing volumes, purging will be deemed complete.

### 2.3.5 Sampling

When the volume purging criteria have been achieved, the pumping rate will be decreased to about 0.1 gpm and groundwater samples will be collected from the pump discharge into appropriate laboratory-supplied containers. In addition to the collection of samples for submission to the project analytical laboratory, samples will be tested at each wellhead for ferrous iron (Fe(II)) using a Hach, Inc. field test kit. Samples will be stored on ice in a cooler and transported by courier to a California-certified analytical laboratory for analysis under proper chain-of-custody protocols. Chain-of-custody forms will be maintained throughout sample collection and transport. An example chain-of-custody form is provided in Appendix A. The appropriate chain-of-custody information will also be electronically uploaded to the project database.

### 2.3.6 Miscellaneous

Equipment used for well purging and sampling will be cleaned prior to and between groundwater monitoring wells with an Alconox solution (or equivalent), then double-rinsed with tap water and deionized or distilled water to reduce the potential for cross-contamination. Well purge water and water used to decontaminate equipment will be stored in properly labeled, UN-approved 55-gallon drums or other approved containers and stored onsite at a location selected by BCRE. The water will be properly manifested and disposed of by Avocet following receipt of the laboratory results.

Groundwater analytical results will be reported on RWQCB Laboratory Report Forms 10A/10B or their equivalent in units of milligrams per liter (mg/L) or micrograms per liter (µg/l), as appropriate. Field data will be collected and recorded on standard groundwater monitoring forms, and the laboratory data will be submitted electronically for upload to the project database.

### 2.3.7 Quality Assurance/Quality Control

#### *2.3.7.1 Duplicate Samples*

One duplicate groundwater sample will be collected for every 20 groundwater samples as a check for sample homogeneity and laboratory precision (three samples in March and two in September). Duplicates will be collected, packaged, and sealed in the same manner as the primary samples. Duplicates will be assigned separate sample numbers and submitted blind to the laboratory. Duplicate samples will be analyzed for VOCs using EPA Method 8260B.

#### *2.3.7.2 Equipment/Rinsate Blanks*

One equipment/rinsate blank sample will be collected prior to the initiation of sampling activities as a check for cross-contamination. Another sample will be collected each day, throughout the duration of the sampling event, when sampling equipment is cleaned and reused in the field as a check for cross-contamination (an estimated eight samples in March and five samples in September). Deionized water, provided by the laboratory and used to prepare the trip blanks, will be used to fill or rinse the sampling equipment after the equipment has been cleaned, then collected in sample containers. The equipment/rinsate blanks will be analyzed for VOCs using EPA Method 8260B.

#### *2.3.7.3 Trip Blanks*

One trip blank will be prepared in the laboratory for each day that groundwater samples are collected and shipped to the laboratory (an estimated eight samples in March and five samples in September). The trip blanks will be prepared in a clean environment and kept in the cooler used to ship the samples. The trip blank provides a check for contamination during transport and will be analyzed for VOCs using EPA Method 8260B.

#### *2.3.7.4 Data Validation*

A subcontractor will perform data validation in accordance with U.S. Environmental Protection Agency (EPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA, 1999 and 2001). Approximately 10 percent of the laboratory data for the primary samples will be reviewed during each monitoring event to verify that the data are of sufficient quality (six samples from the March annual event and three samples from the September semiannual event). The data packages to be validated will be selected randomly. Approximately 55 percent of the selected data packages will be subjected to Tier 1 validation and 40 percent will be subjected to Tier 2 validation.

# 3.0 GROUNDWATER MONITORING REPORT

The report for the annual groundwater monitoring event will contain the following:

- Groundwater elevation contour maps for the B-Sand, the C-Sand, and the Gage aquifer
- Hydrographs for the B-Sand, the C-Sand, and the Gage aquifer
- Concentration-versus-time graphs for select wells and select VOCs in the B- and C-Sands
- Groundwater isoconcentration maps for key compounds of concern at the site (trichloroethene and 1,1-dichloroethene) for the B-Sand and C-Sand
- Tables summarizing groundwater analytical results
- Groundwater sampling forms documenting field activities
- Laboratory reports and chain-of-custody documentation
- Data validation reports
- Appropriate descriptions of the field activities and analytical results
- Recommendations for modifications to the sampling program, as appropriate.

The report for the semiannual groundwater monitoring event will contain the following:

- Groundwater elevation contour maps for the B-Sand, the C-Sand, and the Gage aquifer
- Tables and figures presenting the groundwater analytical results
- Groundwater sampling forms documenting field activities
- Laboratory reports and chain-of-custody documentation
- Data validation reports
- Appropriate descriptions of the field activities and analytical results.

Reports will be submitted to the LARWQCB approximately 60 days after receipt of the laboratory results from each sampling event. With the annual and semiannual monitoring events occurring in March and September 2008, reports for these events will be provided to the

LARWQCB by May 30 and November 28, 2008, respectively. The reports will consist of a hard copy of text, tables, figures, and the appendices containing the field and laboratory data. The reports will also be uploaded over the internet onto the State Water Resources Control Board GeoTracker data management system.

Respectfully submitted,

AVOCET ENVIRONMENTAL, INC.

Michael A. Rendina, P.G.
Principal

# REFERENCES

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# *Tables*

AVOCET
ENVIRONMENTAL, INC.

# Table 1
## Groundwater Monitoring Well Completion Details
Boeing Former C-6 Facility
Los Angeles, California

| Well I.D. | Water-Bearing Unit | Easting[1,3] | Northing[1,3] | Reference Elevation (feet amsl)[2] | Boring Total Depth (feet) | Screen Depth Interval (feet) | Depth to Top of Filter Pack (feet) | Casing Diameter (inches) | Casing Type | Slot Size (inches) | Drilled Date |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B-Sand Monitoring Wells** | | | | | | | | | | | |
| BL-03 | B-Sand | 6,468,962 | 1,768,747 | 58.66 | 79 | 59-79 | 56 | 2 | Sch 40 PVC | 0.01 | 02/08/99 |
| DAC-P1 | B-Sand | 6,468,953 | 1,769,774 | 55.13 | 90 | 60-90 | 55 | 4 | Sch 40 PVC | 0.01 | 09/25/89 |
| EWB0014 | B-Sand | 6,470,381 | 1,769,604 | 53.01 | 90 | 59.2-89.2 | 56 | 6 | Sch 80 PVC | 0.02 | 11/09/06 |
| EWB002 | B-Sand | 6,470,279 | 1,769,773 | 53.74 | 90 | 60-90 | 56 | 6 | Sch 80 PVC | 0.02 | 06/13/07 |
| MWB005 | B-Sand | 6,470,232 | 1,769,063 | 52.1 | 85 | 65-85 | 63 | 4 | Sch 40 PVC | 0.01 | 08/08/03 |
| MWB003 | B-Sand | 6,470,193 | 1,769,474 | 56.95 | 92 | 65-90 | 63 | 2 | Sch 40 PVC | 0.02 | 11/30/05 |
| MWB006 | B-Sand | 6,470,251 | 1,770,051 | 53.9 | 93 | 65-90 | 63 | 2 | Sch 40 PVC | 0.02 | 12/01/05 |
| MWB007 | B-Sand | 6,470,211 | 1,770,213 | 51.39 | 92 | 60-90 | 57 | 4 | Sch 40 PVC | 0.02 | 06/06/05 |
| MWB012 | B-Sand | 6,470,035 | 1,769,019 | 52.43 | 90.5 | 64.5-84.5 | 62 | 4 | Sch 40 PVC | 0.02 | 05/17/04 |
| MWB013 | B-Sand | 6,469,592 | 1,769,396 | 55.33 | 86.5 | 65-85 | 62 | 4 | Sch 40 PVC | 0.02 | 05/17/04 |
| MWB014 | B-Sand | 6,470,280 | 1,768,387 | 51.69 | 86.5 | 65-85 | 62 | 4 | Sch 40 PVC | 0.02 | 05/17/04 |
| MWB019 | B-Sand | 6,469,970 | 1,768,093 | 55.18 | 90.5 | 65-85 | 62 | 4 | Sch 40 PVC | 0.02 | 05/17/04 |
| MWB020 | B-Sand | 6,470,396 | 1,770,863 | 51.07 | 120.5 | 59.5-89.5 | 56 | 4 | Sch 40 PVC | 0.02 | 06/06/05 |
| MWB027 | B-Sand | 6,469,948 | 1,769,934 | 57.14 | 91.5 | 67.5-87.5 | 65 | 2 | Sch 40 PVC | 0.02 | 11/30/05 |
| MWB028 | B-Sand | 6,470,106 | 1,769,475 | 56.84 | 93 | 65-90 | 63 | 2 | Sch 40 PVC | 0.02 | 12/01/05 |
| TMW_4 | B-Sand | 6,470,254 | 1,769,116 | 51.39 | 84 | 58-78 | 56 | 2 | Sch 40 PVC | 0.01 | 06/30/98 |
| TMW_6 | B-Sand | 6,470,299 | 1,768,718 | 51.72 | 93 | 67-87 | 66 | 2 | Sch 40 PVC | 0.01 | 07/01/98 |
| TMW_7 | B-Sand | 6,470,318 | 1,769,483 | 53.96 | 91 | 65-85 | 63 | 2 | Sch 40 PVC | 0.01 | 06/29/98 |
| TMW_8 | B-Sand | 6,470,329 | 1,769,594 | 53.98 | 90 | 61-81 | 59 | 2 | Sch 40 PVC | 0.01 | 06/29/98 |
| TMW_10 | B-Sand | 6,470,723 | 1,768,951 | 49.92 | 85 | 60.5-80.5 | 58 | 2 | Sch 40 PVC | 0.01 | 01/28/99 |
| TMW_11 | B-Sand | 6,470,721 | 1,768,204 | 49.85 | 83 | 58-78 | 55 | 2 | Sch 40 PVC | 0.01 | 02/01/99 |
| TMW_14 | B-Sand | 6,469,550 | 1,768,199 | 58.91 | 90 | 65-85 | 63 | 2 | Sch 40 PVC | 0.01 | 02/03/99 |
| TMW_15 | B-Sand | 6,469,555 | 1,768,950 | 57.65 | 92 | 62-87 | 60 | 2 | Sch 40 PVC | 0.01 | 02/04/99 |
| WCC_3S | B-Sand | 6,470,367 | 1,770,021 | 52.8 | 92 | 69-89 | 64 | 4 | Sch 40 PVC | 0.01 | 10/26/87 |
| WCC_4S | B-Sand | 6,470,499 | 1,769,857 | 52.23 | 92 | 70.5-90.5 | 65 | 4 | Sch 40 PVC | 0.01 | 10/27/87 |
| WCC_5S | B-Sand | 6,470,722 | 1,769,779 | 52.82 | 91 | 61-91 | 64 | 4 | Sch 40 PVC | 0.01 | 11/24/87 |
| WCC_6S | B-Sand | 6,470,336 | 1,769,734 | 52.7 | 91 | 60-90 | 54 | 4 | Sch 40 PVC | 0.01 | 09/22/89 |
| WCC_7S | B-Sand | 6,470,505 | 1,769,695 | 52.21 | 91 | 60-90 | 54 | 4 | Sch 40 PVC | 0.01 | 06/08/89 |
| WCC_9S | B-Sand | 6,470,683 | 1,769,409 | 54.96 | 92 | 60-90 | 55 | 4 | Sch 40 PVC | 0.01 | 09/21/89 |
| WCC_12S | B-Sand | 6,470,506 | 1,769,496 | 51.32 | 92 | 60-90 | 55 | 4 | Sch 40 PVC | 0.01 | 09/17/90 |
| XMW-09 | B-Sand | 6,470,407 | 1,767,930 | 53.16 | - | 66-81 | - | 4 | - | - | 05/09/89 |
| XMW-19 | B-Sand | 6,470,722 | 1,768,538 | 49.38 | - | 63-79 | - | 4 | - | - | 03/30/90 |



AVOCET ENVIRONMENTAL, INC.

# Table 1
## Groundwater Monitoring Well Completion Details
Boeing Former C-6 Facility
Los Angeles, California

| Well I.D. | Water-Bearing Unit | Easting[1,3] | Northing[1,3] | Reference Elevation (feet amsl)[2] | Boring Total Depth (feet) | Screen Depth Interval (feet) | Depth to Top of Filter Pack (feet) | Casing Diameter (inches) | Casing Type | Slot Size (inches) | Drilled Date |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **C-Sand Monitoring Wells** | | | | | | | | | | | |
| CMW0001 | C-Sand | 6,470,700 | 1,768,183 | 54.37 | 124 | 99-124 | 97 | 4 | Sch 40 PVC | 0.01 | 08/15/03 |
| CMW0002 | C-Sand | 6,470,554 | 1,767,936 | 52.81 | 124 | 99-124 | 97 | 4 | Sch 40 PVC | 0.01 | 08/14/03 |
| CMW026 | C-Sand | 6,470,279 | 1,768,603 | 51.53 | 117 | 92-117 | 90 | 4 | Sch 40 PVC | 0.01 | 08/06/03 |
| EWC001 | C-Sand | 6,470,359 | 1,769,706 | 52.59 | 125 | 97-122 | 94 | 4 | Sch 80 PVC | 0.02 | 11/08/06 |
| EWC002 | C-Sand | 6,470,267 | 1,768,368 | 51.76 | 125 | 96-121 | 93 | 4 | Sch 80 PVC | 0.02 | 10/20/06 |
| IWC001 | C-Sand | 6,470,121 | 1,768,453 | 53.6 | 125 | 95-115 | 92 | 4 | Sch 80 PVC | 0.02 | 11/02/06 |
| IWC002 | C-Sand | 6,470,239 | 1,768,669 | 51.56 | 125 | 96-116 | 93 | 4 | Sch 80 PVC | 0.02 | 10/31/06 |
| MWC004 | C-Sand | 6,470,486 | 1,769,491 | 51.86 | 118 | 96-116 | 93 | 4 | Sch 40 PVC | 0.02 | 06/07/05 |
| MWC006 | C-Sand | 6,470,252 | 1,770,037 | 54.03 | 117.5 | 95-115 | 93 | 2 | Sch 40 PVC | 0.02 | 11/29/05 |
| MWC007 | C-Sand | 6,470,172 | 1,770,172 | 51.57 | 119 | 97-117 | 93.5 | 4 | Sch 40 PVC | 0.02 | 06/03/05 |
| MWC009 | C-Sand | 6,470,658 | 1,769,365 | 53.99 | 125 | 101-121 | 97.5 | 4 | Sch 40 PVC | 0.02 | 04/28/05 |
| MWC011 | C-Sand | 6,470,263 | 1,769,749 | 54.03 | 117 | 94-114 | 92 | 2 | Sch 40 PVC | 0.02 | 11/29/05 |
| MWC015 | C-Sand | 6,470,304 | 1,768,821 | 51.51 | 128 | 100-125 | 99 | 4 | Sch 40 PVC | 0.02 | 05/17/04 |
| MWC016 | C-Sand | 6,469,987 | 1,768,720 | 52.61 | 131 | 102.5-127.5 | 101 | 4 | Sch 40 PVC | 0.02 | 05/17/04 |
| MWC017 | C-Sand | 6,469,979 | 1,768,093 | 55.16 | 128 | 100-125 | 99 | 4 | Sch 40 PVC | 0.02 | 05/17/04 |
| MWC021 | C-Sand | 6,470,705 | 1,768,939 | 54.53 | 126 | 97-122 | 94.5 | 4 | Sch 40 PVC | 0.02 | 05/17/04 |
| MWC022 | C-Sand | 6,470,454 | 1,769,986 | 51.6 | 120 | 97-117 | 93.5 | 4 | Sch 40 PVC | 0.02 | 06/07/05 |
| MWC023 | C-Sand | 6,470,428 | 1,769,802 | 51.43 | 120 | 97-117 | 94 | 4 | Sch 40 PVC | 0.02 | 06/07/05 |
| MWC024 | C-Sand | 6,470,266 | 1,768,409 | 51.64 | 125 | 96-121 | 93 | 4 | Sch 80 PVC | 0.02 | 10/26/06 |
| **Bioremediation Monitoring Wells** | | | | | | | | | | | |
| IRZB0081 | B-Sand | 6,470,037 | 1,768,714 | 52.92 | - | 64.5-89.5 | 63 | 0.75 | Sch 40 PVC | 0.01 | 09/04/03 |
| IRZB0095 | B-Sand | 6,470,038 | 1,768,619 | 52.7 | - | 65-90 | 63.2 | 0.75 | Sch 40 PVC | 0.01 | 09/05/03 |
| IRZMW001A | B-Sand | 6,469,844 | 1,768,988 | 56.77 | - | 65-75 | 63 | 1.5 | Sch 40 PVC | 0.01 | 06/26/02 |
| IRZMW001B | B-Sand | 6,469,844 | 1,768,988 | 56.7 | - | 80-90 | 79 | 1.5 | Sch 40 PVC | 0.01 | 06/26/02 |
| IRZMW002A | B-Sand | 6,469,840 | 1,768,989 | 56.66 | - | 68-78 | 66 | 1.5 | Sch 40 PVC | 0.01 | 06/03/03 |
| IRZMW002B | B-Sand | 6,469,840 | 1,768,989 | 56.76 | - | 83-93 | 82 | 1.5 | Sch 40 PVC | 0.01 | 06/03/03 |
| IRZMW003A | B-Sand | 6,469,867 | 1,768,985 | 56.73 | - | 61-71 | 60 | 1.5 | Sch 40 PVC | 0.01 | 06/02/03 |
| IRZMW003B | B-Sand | 6,469,867 | 1,768,985 | 56.78 | - | 80-90 | 79 | 1.5 | Sch 40 PVC | 0.01 | 06/02/03 |
| IRZMW004 | B-Sand | 6,470,051 | 1,768,610 | 53.06 | - | 65-90 | 63 | 4 | Sch 40 PVC | 0.01 | 09/04/03 |
| IRZMW005 | B-Sand | 6,470,038 | 1,768,708 | 52.77 | - | 65-90 | 63 | 4 | Sch 40 PVC | 0.01 | 09/05/03 |
| IRZCMW001 | C-Sand | 6,470,218 | 1,768,660 | 51.74 | - | 92-117 | 90 | 4 | Sch 40 PVC | 0.01 | 08/06/03 |
| IRZCMW002 | C-Sand | 6,470,417 | 1,768,410 | 55.6 | - | 96-121 | 94 | 4 | Sch 40 PVC | 0.01 | 05/12/04 |
| IRZCMW003 | C-Sand | 6,470,298 | 1,768,593 | 51.69 | - | 92-117 | 90 | 4 | Sch 40 PVC | 0.01 | 08/08/03 |



AVOCET ENVIRONMENTAL, INC.

**Table 1**
**Groundwater Monitoring Well Completion Details**
Boeing Former C-6 Facility
Los Angeles, California

| Well I.D. | Water-Bearing Unit | Easting[1,3] | Northing[1,3] | Reference Elevation (feet amsl)[2] | Boring Total Depth (feet) | Screen Depth Interval (feet) | Depth to Top of Filter Pack (feet) | Casing Diameter (inches) | Casing Type | Slot Size (inches) | Drilled Date |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Gage Monitoring Wells** | | | | | | | | | | | |
| MWG001 | Gage Aquifer | 6,470,706 | 1,769,149 | 54.13 | 190 | 156-186 | 152 | 2 | Sch 40 PVC | 0.02 | 04/22/05 |
| MWG002 | Gage Aquifer | 6,470,705 | 1,768,452 | 54.78 | 195 | 162-192 | 158 | 2 | Sch 40 PVC | 0.02 | 04/28/05 |
| MWG003 | Gage Aquifer | 6,470,056 | 1,768,915 | 53.079 | 185 | 154.5-184.5 | 150 | 2 | Sch 40 PVC | 0.02 | 09/12/05 |
| MWG004 | Gage Aquifer | 6,470,230 | 1,768,389 | 52.049 | 186 | 155-185 | 150 | 2 | Sch 40 PVC | 0.02 | 09/12/05 |

Notes:
(1) California State Plane North American Datum of 83 (NAD 83), Zone 5, Feet
(2) feet amsl = feet above mean sea level. Elevations based on North American Vertical Datum of 1988 (NAVD 88)
(3) Coordinates were slightly revised based on additional survey done in November 2006
(4) Well EWB001 contains a permanent pump. The top of casing was modified when a vault was installed. Total depth (below top of casing [BTC]) prior to modification was 88.7 feet. Total depth after modification is 84.7 feet (i.e., approximately 4 feet of casing was removed - new TOC elevation approximately 49.01 feet amsl). The well is equipped with a transducer. The transducer was installed approximately 78.15 feet BTC. On December 12, 21.6 feet of water covered the transducer - a water level of 56.55 feet BTC. This equates to a water table elevation on 12/12 of -7.54 feet amsl.
"-" = unknown

# Table 2
## 2008 Groundwater Monitoring Program
Boeing Former C-6 Facility
Los Angeles, California

| Well ID | Water-Bearing Unit | March 2008 Annual Event Analytical Program | | | September 2008 Semiannual Analytical Program | | |
|---|---|---|---|---|---|---|---|
| | | Water Level Gauging | VOCs (8260B) | Field Parameters[1] | Water Level Gauging | VOCs (8260B) | Field Parameters[1] |
| **B-Sand Monitoring Wells** | | | | | | | |
| BL-03 | B-Sand | x | x | x | x | | |
| DAC-P1 | B-Sand | x | x | x | x | | |
| EWB001 | B-Sand | x | x | x | | | |
| EWB002 | B-Sand | x | x | x | | | |
| MW0005 | B-Sand | x | x | x | x | | |
| MWB003 | B-Sand | x | x | x | | | |
| MWB006 | B-Sand | x | x | x | | | |
| MWB007 | B-Sand | x | x | x | x | x | x |
| MWB012 | B-Sand | x | x | x | | | |
| MWB013 | B-Sand | x | x | x | x | x | x |
| MWB014 | B-Sand | x | x | x | x | | |
| MWB019 | B-Sand | x | x | x | x | x | x |
| MWB020 | B-Sand | x | x | x | x | x | x |
| MWB027 | B-Sand | x | x | x | x | x | x |
| MWB028 | B-Sand | x | x | x | x | | |
| TMW_04 | B-Sand | x | | | | | |
| TMW_06 | B-Sand | x | x | x | x | | |
| TMW_07 | B-Sand | x | x | x | | | |
| TMW_08 | B-Sand | x | x | x | | | |
| TMW_10 | B-Sand | x | x | x | x | x | x |
| TMW_11 | B-Sand | x | x | x | x | x | x |
| TMW_14 | B-Sand | x | x | x | x | x | x |
| TMW_15 | B-Sand | x | x | x | x | x | x |
| WCC_3S | B-Sand | x | x | x | x | x | x |
| WCC_4S | B-Sand | x | x | x | x | x | x |
| WCC_5S | B-Sand | x | x | x | x | x | x |
| WCC_6S | B-Sand | x | x | x | | | |
| WCC_7S | B-Sand | x | x | x | x | x | x |
| WCC_9S | B-Sand | x | x | x | x | x | x |
| WCC_12S | B-Sand | x | x | x | x | x | x |
| XMW-09 | B-Sand | x | x | x | x | x | x |
| XMW-19 | B-Sand | x | x | x | x | x | x |
| **C-Sand Monitoring Wells** | | | | | | | |
| CMW001 | C-Sand | x | x | x | x | x | x |
| CMW002 | C-Sand | x | x | x | x | x | x |
| CMW026 | C-Sand | x | x | x | | | |
| EWC001 | C-Sand | x | x | x | | | |
| EWC002 | C-Sand | x | x | x | x | | |
| IWC001 | C-Sand | x | x | x | x | | |
| IWC002 | C-Sand | x | x | x | | | |
| MWC004 | C-Sand | x | x | x | x | x | x |
| MWC006 | C-Sand | x | x | x | | | |
| MWC007 | C-Sand | x | x | x | x | x | x |
| MWC009 | C-Sand | x | x | x | x | x | x |
| MWC011 | C-Sand | x | x | x | | | |



AVOCET ENVIRONMENTAL, INC.

# Table 2
## 2008 Groundwater Monitoring Program
Boeing Former C-6 Facility
Los Angeles, California

| Well ID | Water-Bearing Unit | March 2008 Annual Event Analytical Program | | | September 2008 Semiannual Analytical Program | | |
|---|---|---|---|---|---|---|---|
| | | Water Level Gauging | VOCs (8260B) | Field Parameters[1] | Water Level Gauging | VOCs (8260B) | Field Parameters[1] |
| MWC015 | C-Sand | x | x | x | x | | |
| MWC016 | C-Sand | x | x | x | | | |
| MWC017 | C-Sand | x | x | x | x | x | x |
| MWC021 | C-Sand | x | x | x | x | x | x |
| MWC022 | C-Sand | x | x | x | x | x | x |
| MWC023 | C-Sand | x | x | x | x | x | x |
| MWC024 | C-Sand | x | x | x | | | |
| **Gage Monitoring Wells** | | | | | | | |
| MWG001 | Gage | x | x | x | x | x | x |
| MWG002 | Gage | x | x | x | x | x | x |
| MWG003 | Gage | x | x | x | x | | |
| MWG004 | Gage | x | x | x | x | | |
| **Bioremediation Monitoring Wells** | | | | | | | |
| IRZB0081 | B-Sand | x | x | x | | | |
| IRZB0095 | B-Sand | x | x | x | | | |
| IRZMW001A | B-Sand | x | x | x | | | |
| IRZMW001B | B-Sand | x | x | x | | | |
| IRZMW002A | B-Sand | x | | | | | |
| IRZMW002B | B-Sand | x | | | | | |
| IRZMW003A | B-Sand | x | | | | | |
| IRZMW003B | B-Sand | x | | | | | |
| IRZMW004 | B-Sand | x | x | x | | | |
| IRZMW005 | B-Sand | x | x | x | | | |
| IRZCMW001 | C-Sand | x | x | x | | | |
| IRZCMW002 | C-Sand | x | x | x | | | |
| IRZCMW003 | C-Sand | x | x | x | x | | |
| **Quality Control Samples[2]** | | | | | | | |
| Duplicates (1 per 20 wells) | | | x ( 4) | | | x ( 2 ) | |
| Rinseate Blanks (1 per day) | | | x ( 8 ) | | | x ( 5 ) | |
| Trip Blanks (1 per day) | | | x ( 8 ) | | | x ( 5 ) | |

**Notes:**

VOCs = volatile organic compounds using EPA Method 8260B

Field Parameters = pH, dissolved oxygen (DO), redox, turbidity, electrical conductivity, and temperature.

(1) As a quality assurance check on DO measurements, 10 percent of the samples will be analyzed in the field using a CHEMetrics, Inc test kit (K-7512 or K-7540).

(2) Quality control sample number based on estimated number of sampling days.



AVOCET ENVIRONMENTAL, INC.

# *Figures*

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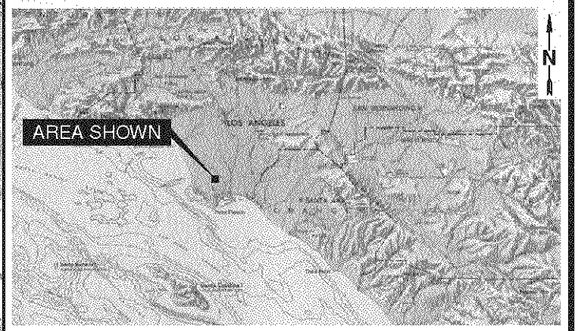
V:\1155_Boeing_Former_C-6\1155.001\002_1155.001_Site_Location_Map.ai\12/27/07

BOEING FORMER C-6 FACILITY




**SITE VICINITY MAP**

NOT TO SCALE

REFERENCE:
7.5 MINUTE U.S.G.S. TOPOGRAPHIC
MAP OF TORRANCE, CALIFORNIA
DATED: 1964
PHOTOREVISED: 1981

0 2000 4000 FEET

APPROXIMATE
SCALE

FIGURE 1

## SITE LOCATION MAP

BOEING CORPORATE REAL ESTATE
FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA

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# *Appendix A*

*Field Forms*

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# GROUNDWATER SAMPLING DATA SHEET

| | | | |
|---|---|---|---|
| **Project Name:** | | **Date:** | |
| **Project No.:** | | **Prepared by:** | |
| **Well Identification** | | **Weather:** | |
| **Measurement Point Description** | | **Pump Intake:** | **Screen:** |

| A | B | C | D | E | G | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Depth to LNAPL** (ft-bmp) | **Depth to Static Water Level** (ft-bmp) | **Well Total Depth** (ft-bmp) | **Water Column Height** (ft) (C-B=D) | **LNAPL Thickness** (ft) (B-A=E) | **One Casing Volume** (gallons) (DxF=G) | **Three Casing Volumes** (gallons) (Gx3) | **One-Half Casing Volume** (G/2) | **Above Screen Volume** (top screen - DTW) x F | **Screen Volume** (screen length x F) |
| | | | | | | | | | |

| | **Gallons/Foot** | | | | **Field Equipment:** |
|---|---|---|---|---|---|
| **Well Diameter** (inches) | 0.75 | 2 | 4 | 6 | **Purge Method:** |
| (F) - **Gallons per foot of casing** | 0.02 | 0.16 | 0.65 | 1.47 | **Well Condition:** |

| **Time** | **Casing/ Screen** | **Volume Purged** (gallons) | **Flow Rate** (gpm) | **Water Level** (ft-bmp) | **pH** | **Temperature** (°C) | **Turbidity** (NTU) | **Conductivity** ( ) | **Dissolved Oxygen** (mg/L) | **ORP** (mV) | **Observations** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

| **Purge Start Time** | **Purge End Time** | **Average Flow** (gpm) | **Total Gallons Purged** | **Total Casing Volumes Purged** | **80% Recovery Water Level Depth** (Dx0.20) + B | **Water Level at Sampling Time** (ft bmp) | **Sample Collection Time** | **Sample Identification** |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**Notes:**

# Groundwater Monitoring Well Gauging Sheet
## BCRE Former C-6 Facility

| Well ID | Previous Measurement Date | Previous Depth to Water | Previous Total Depth | Date | Time | Well Diameter | PID (ppm) | Measurement Point | Depth to Water | Depth to Water #2 | Total Depth | Personnel | Comments/Well Conditon |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EWB001 | Sep-07 | 60.15 | 88.95 | | | | | TOC-N | | | | | |
| EWC001 | Sep-07 | 59.8 | 123.21 | | | | | TOC-N | | | | | |
| CMW0001 | Sep-07 | 63.05 | 124.35 | | | | | TOC-N | | | | | |
| MWC024 | Sep-07 | 60.02 | 121.35 | | | | | TOC-N | | | | | |
| IRZMW002B | Sep-07 | 64.63 | 89.92 | | | | | TOC-N | | | | | |
| IRZCMW002 | Sep-07 | 64.49 | 121.22 | | | | | TOC-N | | | | | |
| IRZB0081 | Sep-07 | 61.85 | 83.55 | | | | | TOC-N | | | | | |
| IRZB0095 | Sep-07 | 61.74 | 84.44 | | | | | TOC-N | | | | | |
| CMW026 | Sep-07 | 59.73 | 119.62 | | | | | TOC-N | | | | | |
| IRZMW003B | Sep-07 | 64.52 | 93.2 | | | | | TOC-N | | | | | |
| CMW0002 | Sep-07 | 61.38 | 124.07 | | | | | TOC-N | | | | | |
| IRZMW005 | Sep-07 | 60.78 | 88.16 | | | | | TOC-N | | | | | |
| IRZMW001B | Sep-07 | 64.42 | 89.9 | | | | | TOC-N | | | | | |
| EWC002 | Sep-07 | 60.21 | 121.51 | | | | | TOC-N | | | | | |
| IWC002 | Sep-07 | 59.7 | 116.01 | | | | | TOC-N | | | | | |
| IRZMW004 | Sep-07 | 61.36 | 90.65 | | | | | TOC-N | | | | | |
| IWC001 | Sep-07 | 62.05 | 114 | | | | | TOC-N | | | | | |
| IRZCMW001 | Sep-07 | 59.29 | 116.3 | | | | | TOC-N | | | | | |
| IRZMW001A | Sep-07 | 64.71 | 75.21 | | | | | TOC-N | | | | | |
| IRZMW003A | Sep-07 | 64.47 | 76.63 | | | | | TOC-N | | | | | |
| IRZMW002A | Sep-07 | 64.94 | 77.7 | | | | | TOC-N | | | | | |
| IRZCMW003 | Sep-07 | 60.07 | 117.58 | | | | | TOC-N | | | | | |
| TMW_6 | Sep-07 | 59.85 | 78.4 | | | | | TOC-N | | | | | |
| MWC015 | Sep-07 | 59.7 | 120.42 | | | | | TOC-N | | | | | |
| MWB019 | Sep-07 | 63.8 | 85.11 | | | | | TOC-N | | | | | |
| MWC017 | Sep-07 | 64.05 | 126.91 | | | | | TOC-N | | | | | |
| MWC016 | Sep-07 | 61.3 | 128 | | | | | TOC-N | | | | | |
| TMW_4 | Sep-07 | 59.26 | 77 | | | | | TOC-N | | | | | |
| MWC004 | Sep-07 | 59.24 | 114.51 | | | | | TOC-N | | | | | |
| MWB007 | Sep-07 | 58.18 | 90.71 | | | | | TOC-N | | | | | |
| WCC_4S | Sep-07 | 59.23 | 89.73 | | | | | TOC-N | | | | | |
| DAC-P1 | Sep-07 | 62.44 | 89.95 | | | | | TOC-N | | | | | |
| MWC006 | Sep-07 | 60.92 | 116.71 | | | | | TOC-N | | | | | |
| MWB006 | Sep-07 | 60.8 | 92.9 | | | | | TOC-N | | | | | |
| MWB005 | Sep-07 | 59.9 | 87.6 | | | | | TOC-N | | | | | |

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# Groundwater Monitoring Well Gauging Sheet
## BCRE Former C-6 Facility

| Well ID | Previous Measurement Date | Previous Depth to Water | Previous Total Depth | Date | Time | Well Diameter | PID (ppm) | Measurement Point | Depth to Water | Depth to Water #2 | Total Depth | Personnel | Comments/Well Conditon |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MWC023 | Sep-07 | 58.54 | 116.11 | | | | | TOC-N | | | | | |
| WCC_3S | Sep-07 | 59.66 | 87.89 | | | | | TOC-N | | | | | |
| MWB028 | Sep-07 | 64.28 | 90.26 | | | | | TOC-N | | | | | |
| MWB027 | Sep-07 | 64.1 | 88.92 | | | | | TOC-N | | | | | |
| MWB003 | Sep-07 | 64.31 | 90.1 | | | | | TOC-N | | | | | |
| MWG003 | Sep-07 | 61.92 | 184.5 | | | | | TOC-N | | | | | |
| TMW_8 | Sep-07 | 61.28 | 80.96 | | | | | TOC-N | | | | | |
| MWG001 | Sep-07 | 63.25 | 185.93 | | | | | TOC-N | | | | | |
| WCC_9S | Sep-07 | 62.33 | 89.98 | | | | | TOC-N | | | | | |
| MWB020 | Sep-07 | 57.24 | 119.81 | | | | | TOC-N | | | | | |
| MWC011 | Sep-07 | 61.3 | 114.11 | | | | | TOC-N | | | | | |
| BL-03 | Sep-07 | 67.15 | 78.95 | | | | | TOC-N | | | | | |
| MWB012 | Sep-07 | 61.94 | 84.02 | | | | | TOC-N | | | | | |
| MWC009 | Sep-07 | 62.72 | 119.6 | | | | | TOC-N | | | | | |
| MWC022 | Sep-07 | 58.6 | 116.09 | | | | | TOC-N | | | | | |
| WCC_7S | Sep-07 | 59.35 | 89.3 | | | | | TOC-N | | | | | |
| MWB014 | Sep-07 | 60.02 | 86.5 | | | | | TOC-N | | | | | |
| XMW-19 | Mar-07 | 57.1 | 76.82 | | | | | TOC-N | | | | | |
| MWC007 | Sep-07 | 58.4 | 118.8 | | | | | TOC-N | | | | | |
| XMW-09 | Mar-07 | 61.77 | 76.38 | | | | | TOC-N | | | | | |
| MWG004 | Sep-07 | 61.39 | 184.25 | | | | | TOC-N | | | | | |
| WCC_5S | Sep-07 | 59.75 | 89.95 | | | | | TOC-N | | | | | |
| MWB013 | Sep-07 | 62.97 | 86.46 | | | | | TOC-N | | | | | |
| MWC021 | Sep-07 | 62.43 | 125.5 | | | | | TOC-N | | | | | |
| TMW_10 | Sep-07 | 57.5 | 77.7 | | | | | TOC-N | | | | | |
| TMW_15 | Sep-07 | 65.91 | 86.92 | | | | | TOC-N | | | | | |
| TMW_11 | Sep-07 | 58.14 | 76.81 | | | | | TOC-N | | | | | |
| TMW_14 | Sep-07 | 67.7 | 84.8 | | | | | TOC-N | | | | | |
| MWG002 | Sep-07 | 64.32 | 192 | | | | | TOC-N | | | | | |
| EWB002 | Dec-07 | 60.93 | 94.3 | | | | | TOC-N | | | | | |
| TMW_7 | Mar-07 | 61.5 | 83.92 | | | | | TOC-N | | | | | |
| WCC_6S | Mar-07 | 60.05 | 84.9 | | | | | TOC-N | | | | | |
| WCC_12S | Mar-07 | 58.62 | 92 | | | | | TOC-N | | | | | |

AVOCET ENVIRONMENTAL, INC.

AVOCET ENVIRONMENTAL, INC.
16 Technology Drive, Suite 154
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TEL (949) 296-0977
FAX (949) 296-0978

Sheet of

Boeing CoC No. AVO121207A

# CHAIN OF CUSTODY RECORD

| Project Information: | |
|---|---|
| Site Name | Boeing Former C-6 Facility - Building 1/36 |
| Site Address | Los Angeles, CA |
| Project No. | 1155.002 |
| Project Manager | Michael Rendina |
| Sampled By | Eric Costales |
| Turn-Around-Time | Standart TAT, 48 hr holding time for $NO_3$ |

| Sample Identification | Sample Date | Sample Time | Matrix | No. of Cntnrs. | Lab I.D. Number | Analyses: VOCs inc. fuel oxys (EPA 8260B) | TOC (EPA 9060) | VFA by iC Method 8M23G (Microseeps, Inc., Pittsburgh, PA) | Dissolved Gases (Ethane, Ethene, and Methane by RSK 175) | Dissolved Minerals (sulfate, Nitrate, nitrite, and chloride) by EPA Method 300 | Total Alkalinity by EPA Method 310 | Quantitative Polymerase Chain Reaction (qPCR) analysis for DHC 16S rRNA gene and functional genes tceA, bvcA, and vcrA (North Wind, Inc., Pocatello, ID) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TB_AV121207_0001 | - | - | Water | 3 | | X | | | | | | | |
| EB_AV121207_0001 | 12/12/07 | | Water | 3 | | X | | | | | | | |
| EWB002_WG121207_0001 | 12/12/07 | | Water | 12 | | X | X | X | X | X | X | X | *48HR HT for $NO_3$* |
| EWB001_WG121207_0001 | 12/12/07 | | Water | 3 | | X | | | | | | | |
| EWC001_WG121207_0001 | 12/12/07 | | Water | 3 | | X | | | | | | | |
| | | | | | | | | | | | | | |
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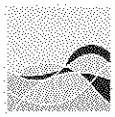
| Relinquished by | Company | Received by | Company |
|---|---|---|---|
| Printed Name: Date: | Avocet Environmental, Inc. | Printed Name: Date: | |
| Signature: Time: | | Signature: Time: | |
| Printed Name: Date: | | Printed Name: Date: | |
| Signature: Time: | | Signature: Time: | |
| Printed Name: Date: | | Printed Name: Date: | |
| Signature: Time: | | Signature: Time: | |

| Sample Receipt | Billing Information | Special Instructions |
|---|---|---|
| Total Containers | | |
| Temperature °C / °F | Bill To: | |
| COC Seal (Y/N/NA) | | |

S:\Projects\1155 Boeing Former C-6 Facility\Groundwater Monitoring\December 2007\COC_121207.xls

# *Appendix B*

## *Water Quality Hydrographs*



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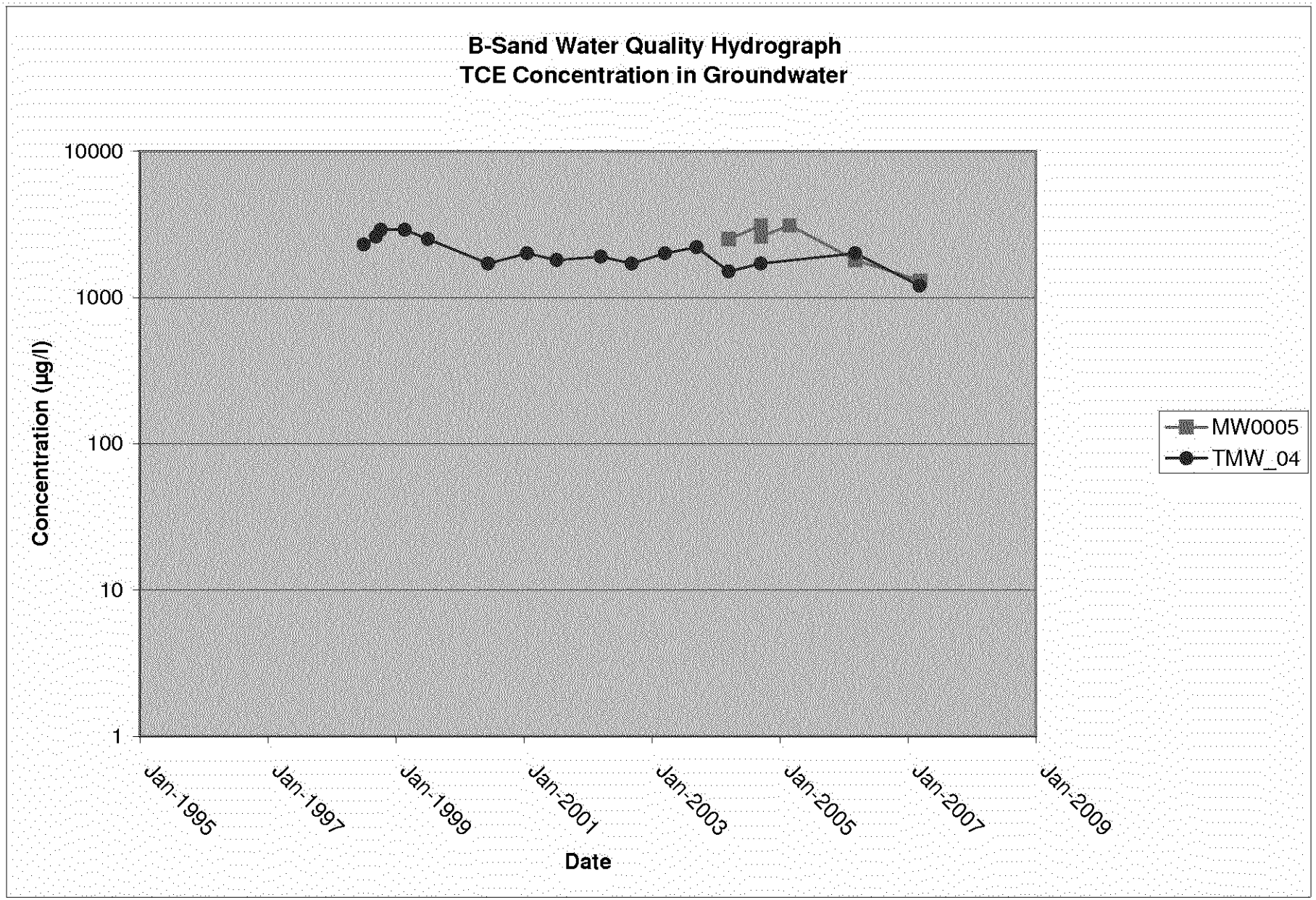


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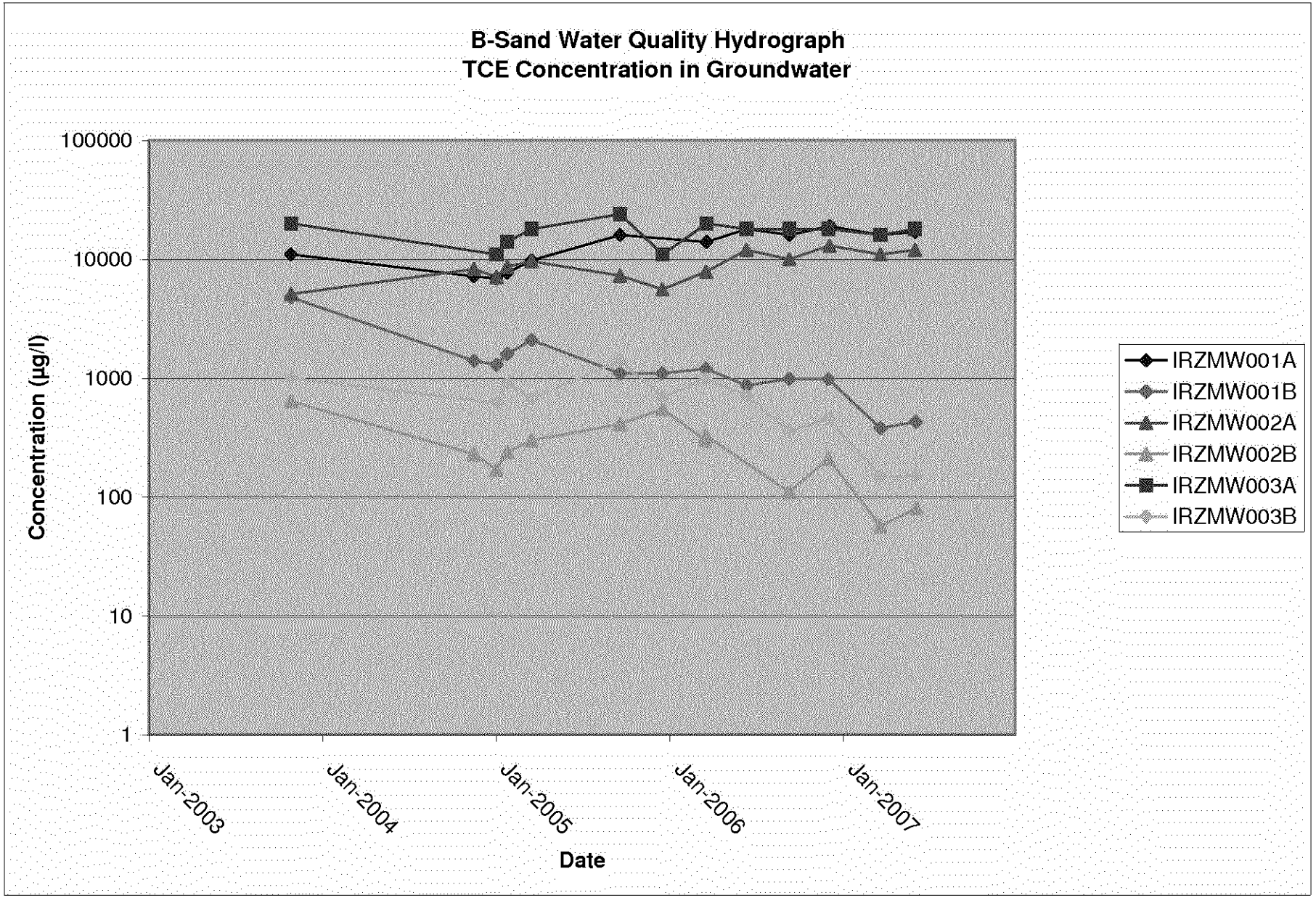


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